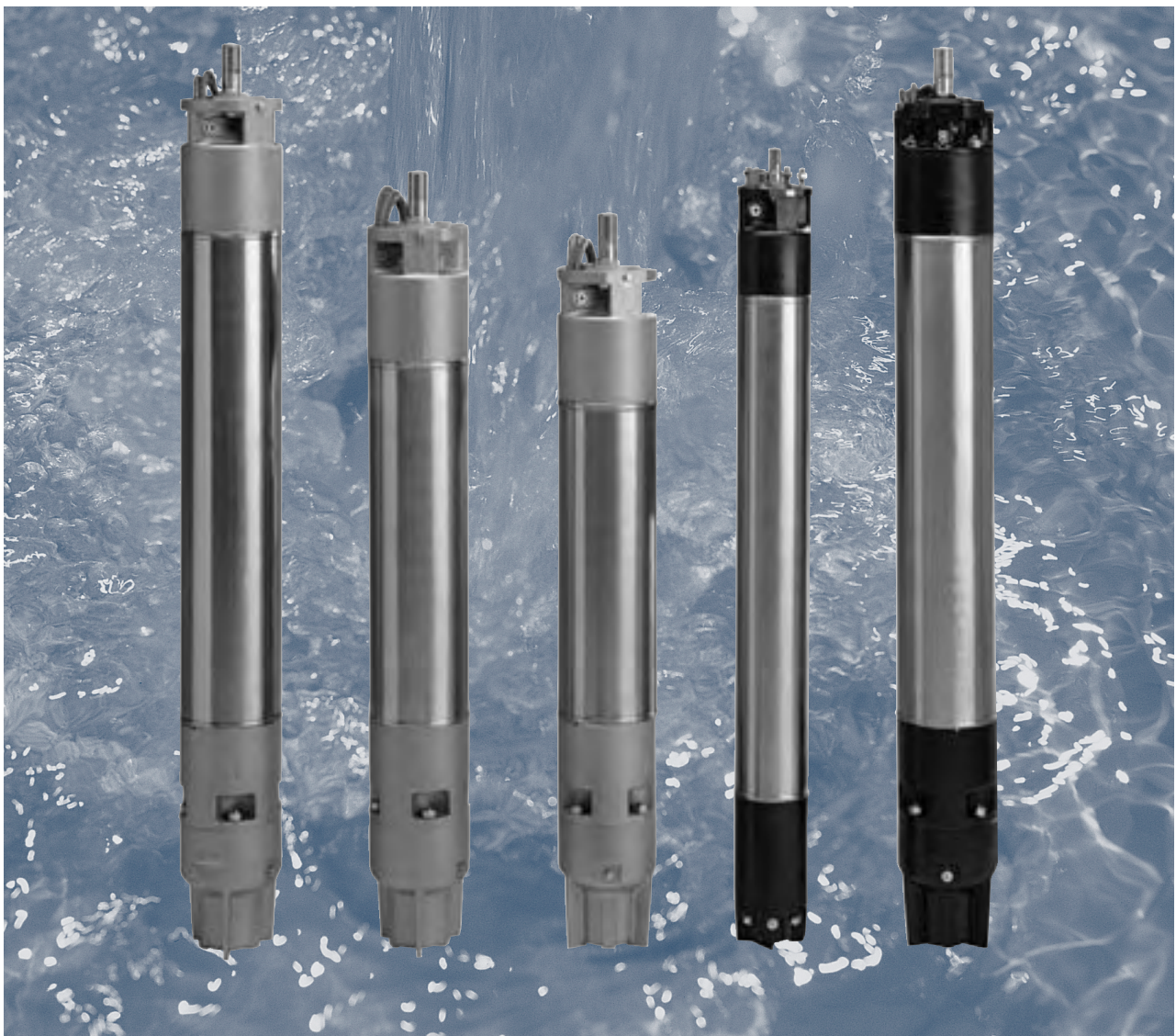


MMS

Rewindable submersible motors and accessories
60 Hz



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- to successfully develop, produce, and sell high quality pumps and pumping systems worldwide, contributing to a better quality of life and healthier environment



GBJ - Bjerringbro, Denmark



GMU - Fresno, California



GPU - Olathe, Kansas



GMX - Monterrey, Mexico



GPA - Allentown, Pennsylvania



GCA - Oakville, Ontario

- One of the 3 largest pump companies in the world
- World headquarters in Denmark
- North American headquarters in Kansas City - Manufacturing in Fresno, California
- 60 companies in 40 countries
- More than 10 million pumps produced annually worldwide
- North American companies operating in USA, Canada and Mexico
- Continuous reinvestment in growth and development enables the company to **BE** responsible, **THINK** ahead, and **INNOVATE**

MMS rewindable motors

The Grundfos MMS product range is a complete range of submersible, rewindable motors, available in sizes from 50HP 6" up to 250HP 10" motors.

Two material versions are available. A cast iron version EN-JL1040. For more aggressive liquids with a moderate content of salt, an N-version made of stainless steel DIN/EN 1.4401 (AISI 316) is available.

Connections and shafts of the 6" and 8" motors are designed according to NEMA standards. The 10" motors are designed according to the drawings shown on page 8. MMS motors comply with the same standards as Grundfos MS motors and can therefore be fitted on all Grundfos SP pumps without the need for adapters.

The motor production is in the hands of experts with many years of experience within the manufacture of motors. In order to make the time of delivery as short as possible, components are manufactured for stock, enabling rapid assembly of a few basic components into the finished motor.

The rewindable motor construction means low costs of repair of the motor in case of damage. Moreover, as rewinding can be effected locally, unnecessary time for transportation of the motor can be avoided and possible periods of downtime reduced to a minimum. The construction of the motor, based on few basic components, also facilitates service and repair of the motor.

Fitted with a sturdy MICHELL thrust bearing, which also functions as an upthrust bearing, all motors offer reliable operation.

In order to achieve maximum protection of the motor against burnout, all motors can be fitted with a Pt100 sensor. Combined with a relay and an optional Grundfos MP 204 control unit, the Pt100 provides optimum protection of the motor.



Fig. 1 MMS 6000 and 8000 standard material

TM01 7873 4999

Product range, 60 Hz

	MMS 6000 (N)	MMS 8000 (N)	MMS 10000 (N)
Motor size	6"	8"	10"
Power range, direct-on-line			
- 3 x 230 V	50HP	50-100HP	–
- 3 x 460 V	50HP	50-150HP	100-250HP
Power range, direct-on-line			
- 3 x 575 V		50-150HP	100-250HP
Allowed installation			
- Vertical	50HP	50-150HP	100-250HP
- Horizontal	50HP	50-125HP	100-200HP

Rewindable motors

The two pole MMS motors are easily rewound. The windings of the stator are made of a special water-proof wire of pure electrolytic copper sheathed with special non-hydroscopic thermoplastic material. The high dielectric strength properties of this material allow direct contact between the windings and the liquid for efficient cooling of the windings.

Type key

Example	MMS	6	000	N
Type range				
Min. borehole diameter in inches				
Generation				
Material:	= Cast iron EN-JL1040 N = DIN/EN 1.4401 (AISI 316)			

High motor efficiency

The complete motor range offered by Grundfos is characterized by high efficiency, which contributes to improved economy of the total pump system.

Overtemperature protection

For protection against overtemperature, Grundfos offers the Pt100 temperature sensor as an optional extra.

The Pt100 is fitted in the motor and can be connected to the MP 204 control unit.

When the temperature becomes too high, the motor will be cut out and damage to the pump be avoided.

Restart of the motor after cut-out can be achieved in two ways:

- manual restart or
- automatic restart.

Automatic restart means that the MP 204 attempts to restart the motor after 15 min. If the first attempt is not successful, restarting will be reattempted at 30-minute intervals.

Protection against upthrust

In case of a very low counter pressure in connection with start-up, there is a risk that the entire pump body may rise, for instance in connection with fountain applications. This is called upthrust, and it may cause damage to both pump and motor. Therefore, the MMS motors are fitted with upthrust spacers, which prevent upthrust in the critical start-up phase.

The maximum load in connection with thrust and upthrust can be seen in the table below.

Motor type	Motor power [kW] (hp)		Thrust (*)	Upthrust
	Min.	Max.	[ft/lbs]	[N]
6"		37 (50)	6000	1300
8"	22 (30)	110 (150)	13000	2800
10"	75 (100)	190 (250)	13000	2800

(*) Double direction of rotation (clockwise and counterclockwise)

Motor protection range and tools for communication

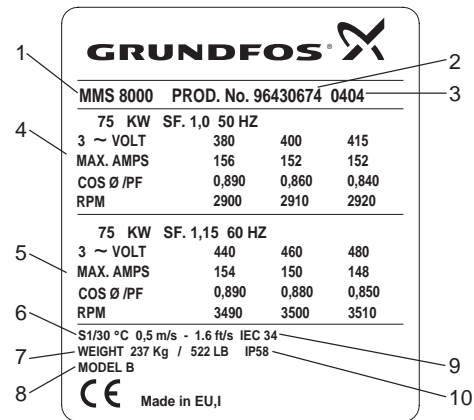
Description	Power	
	50-200HP	250HP
Pt100	•	•
MP 204	•	
R100	•	
G100	•	

Operation

Frequency of starts and stops

Motor type	Number of starts
	Minimum 1 per year is recommended
MMS 6000	Maximum 15 per hour Maximum 360 per day
	Minimum 1 per year is recommended
MMS 8000	Maximum 10 per hour Maximum 240 per day
	Minimum 1 per year is recommended
MMS 10000	Maximum 8 per hour Maximum 190 per day

Name plate



TM01 7408 1204

Pos.	Description	Code
1	Type designation	MMS 8000
2	Product number	PROD. No 96430674
3	Production data (MMYY)	0404
5	Motor data, 60 Hz	See name plate
6	Duty conditions	S1/30°C 0.5 m/s-1.6 ft/s
7	Weight	237 kg/522 LB
8	Model type	Model B
9	International Electrotechnical Commission standard	IEC 34
10	Enclosure Class	IP 58

Voltage quality

The required voltage quality for Grundfos MMS submersible motors, measured at the motor terminals, is -10%/+6% of the nominal voltage during continuous operation (including variations in the supply voltage and losses in cables).



TM01 8447 0200

Fig. 2 Grundfos MMS submersible motor

Operating conditions

Cooling

The cooling of the motor depends on the temperature and the flow velocity of the pumped liquid past the motor. To ensure sufficient cooling, the values for maximum temperature of the pumped liquid and its flow velocity must be kept. It is recommended always to ensure a minimum cooling flow of 0.49 f/s (0.15 m/s).

Free convection

Free convection is achieved when the diameter of the borehole is at least 2" (~ 50 mm) bigger than the outer diameter of the motor. The motor must always be installed above the borehole screen. If a flow sleeve is used, the motor can be placed in the screen.

Calculation of the flow velocity:

$$v = \frac{Q_{\min}}{2826 \times (D_i^2 - d_A^2)} \text{ m/s}$$

Required data:

- Q_{min}: Flow in m³/h
- D_i: Borehole diameter in m
- d_A: Motor diameter in m

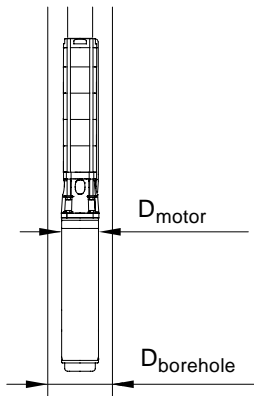


Fig. 3 Flow example

TM02 2269 4001

Maximum liquid temperature:

Motor	Installation		
	Flow velocity past motor	Vertical	Horizontal
Grundfos 6" to 8" rewindable	0.15 m/s	77°F	77°F
	0.50 m/s	86°F	86°F

Note: For MMS 6000, 50HP, MMS 8000, 115HP, the maximum liquid temperature is 9°F lower than the values stated in the table above. For MMS 10000, 250HP the temperature is 18°F lower.

Operating pressure

For all motor sizes: Maximum 870 psi.

Temperature of pumped liquid

Motors with PE/PA windings can operate at temperatures up to 122°F.

For liquid temperatures from 95°F to 122°F, the motors with PE/PA windings can be derated according to the curve below.

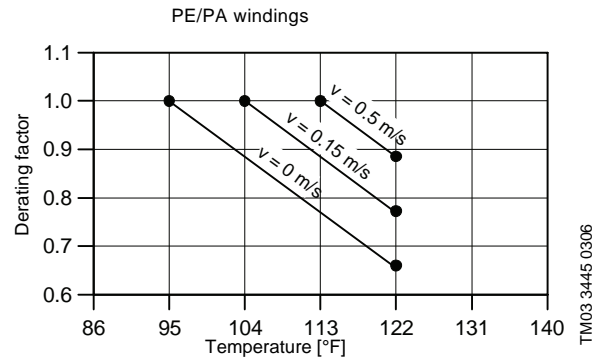


Fig. 4 Derating chart

TM03 3445 0306

Insulation class

PE/PA windings A.

Enclosure class

Enclosure class: IP 58
IP 68 (on request).

Material specification for MMS 6000 to MMS 10000

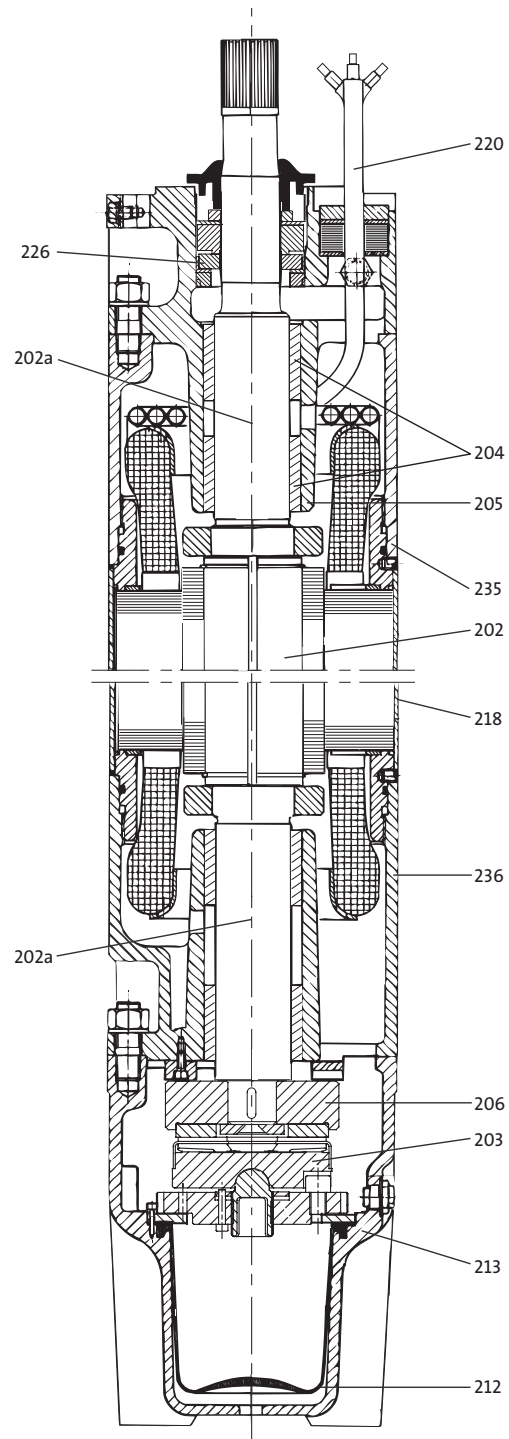
Example: MMS 10000

Cast iron version

Pos.	Component	Material	DIN/EN
202	Shaft	Steel	1.4462
202a	Shaft ends	Stainless steel	
203/ 206	Thrust bearing Stationary/ro- tating part	6" 50HP	Hardened steel/ EPDM
		6" 50HP	Ceramic/carbon
		8"-10"	
204	Bearing ring	6"-10"	Carbon Stainless steel/NBR
205	Bearing housing, upper	Cast iron	EN- JL1040
212	Diaphragm	CR	
213	Motor end shield	Cast iron	EN- JL1040
218	Motor sleeve	Stainless steel	1.4401
220	Motor cable	EPDM	
226	Shaft seal	Ceramic/carbon	
235	Intermediate housing	Cast iron	EN- JL1040
236	Bearing housing, lower	Cast iron	EN- JL1040

N-version

Pos.	Component	Material	DIN/EN
202	Shaft	Steel	1.4462
202a	Shaft ends	Stainless steel	
203/ 206	Thrust bearing Stationary/rotat- ing part	6" 50HP	Hardened steel/ EPDM
		6" 50HP	Ceramic/carbon
		8"-10"	
204	Bearing ring	6"-10"	Carbon Stainless steel/ NBR
205	Bearing housing, upper	Stainless steel	1.4401
212	Diaphragm	CR	
213	Motor end shield	Stainless steel	1.4401
218	Motor sleeve	Stainless steel	1.4401
220	Motor cable	EPDM	
226	Shaft seal	Ceramic/carbon	
235	Intermediate housing	Stainless steel	1.4401
236	Bearing housing, lower	Stainless steel	1.4401



TM01 4985 0404

Pump connection

MMS 6000 and MMS 8000 have connections according to NEMA standard MG 1-18.413.

MMS 10000 connections are according to the drawings to the right.

Shaft and radial bearing

The stainless steel splined shaft end of the 6" and 8" motors fulfills ANSI B92.1, 1970, class 5.

6" motors have 15-teeth module. Pressure angle 30°.
8" motors have 23-teeth module. Pressure angle 30°.
10" motor shafts have keys.

The bearing system for the 6", 8" and 10" motors is stainless steel shaft against carbon bearing rings.

Shaft seal

The mechanical shaft seal is available in SiC/SiC.

SiC/SiC is according to DIN 24960 and available for motors wound for

- 3 x 230 V, 60 Hz and
- 3 x 460 V, 60 Hz only.

The material features high wear resistance and long durability, which ensures tightness and thereby limited replacement of the motor liquid. This is important when the pumped liquid contains sand.

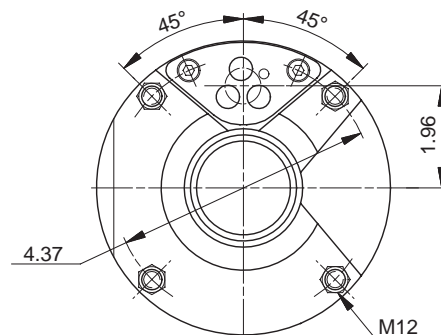
Together with the shaft seal housing, the sand shield forms a labyrinth seal, which during normal operating conditions prevents penetration of sand particles into the shaft seal.

Motor

MMS motors 50HP and up have a squirrel cage rotor with copper bars brazed to the short circuit rings by a silver alloy.

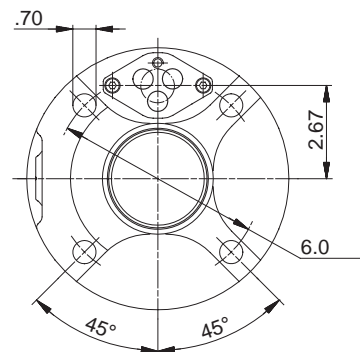
The rotor is dynamically balanced for smooth and vibration-free operation.

MMS 6000 connection



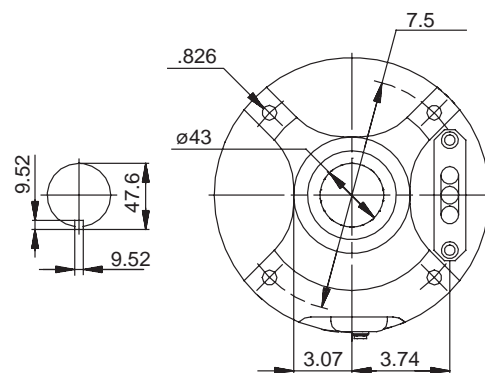
TM03 3474 0406

MMS 8000 connection



TM03 3475 0406

MMS 10000 connection



TM03 3476 0406

Stator

The stator is a wet-wound construction in stainless steel to protect the motor, even in corrosive water. The stator design allows complete access to the winding for easy maintenance and rewinding. The construction of the laminations minimizes operating losses and improves motor performance.

In 6", 8", and 10" motors, the motor end shield is screwed onto the stator. A suitable centring assures alignment of rotor and stator.

Thrust bearing

The MICHELL type of water-lubricated thrust bearing is very simple and most efficient.

The thrust capacity of the bearings is in accordance with NEMA standards for submersible motors, where these are applicable. See drawing to the right.

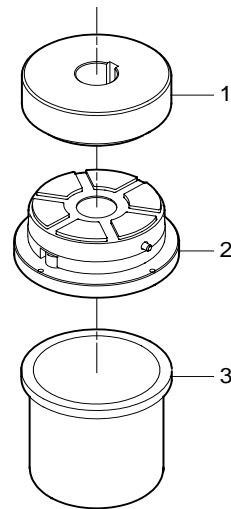
Upthrust bearing

The EPDM upthrust spacers placed above the rotating bearing part prevent motor damage during transportation or in case of upthrust in connection with start-up. The upthrust bearing is an integrated part of the thrust bearing.

Diaphragm

The diaphragm (pos. no. 3) is fitted between the stator and the motor end shield. The diaphragm is dimensioned to equalize pressure variations caused by temperature rises in connection with intermittent operation.

Example: MMS 8000



1. Rotating bearing part
2. Stationary bearing part
3. Diaphragm.

TM01 7331 0604

Motor liquid

The motor is filled with glycerol-containing motor liquid, which is frost-proof down to -4°F .

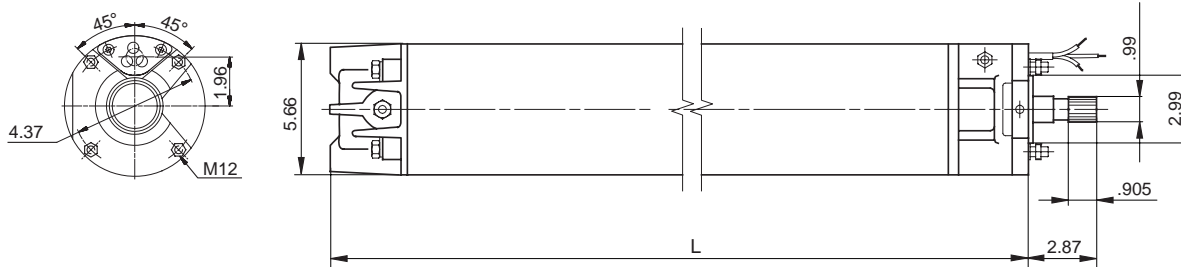
The motor liquid has an anti-corrosive and lubricating function. To obtain the best protection, a concentration of 40% to 60% in water is recommended.

Should the glycerol-containing motor liquid mixed with water not be allowed for special applications, MMS motors may be filled even with fresh water.

Motors not filled with motor liquid are available on request. The following table indicates the freezing points obtainable with various percentages of glycerol-containing motor liquid.

Glycerol-containing motor liquid % volume	Freezing point [$^{\circ}\text{F}$]
40	+24.98
50	+11.3
60	+4.64
70	- 4
80	- 16
90	-33.7
100	-51.7

MMS 6000 (N)



TM03 3467 0406

Motor power		L [in]	Weight [lbs]	Shipping volume [ft ³]
P ₂ [kW]	P ₂ [hp]			
37	50	56.1	276	4.34

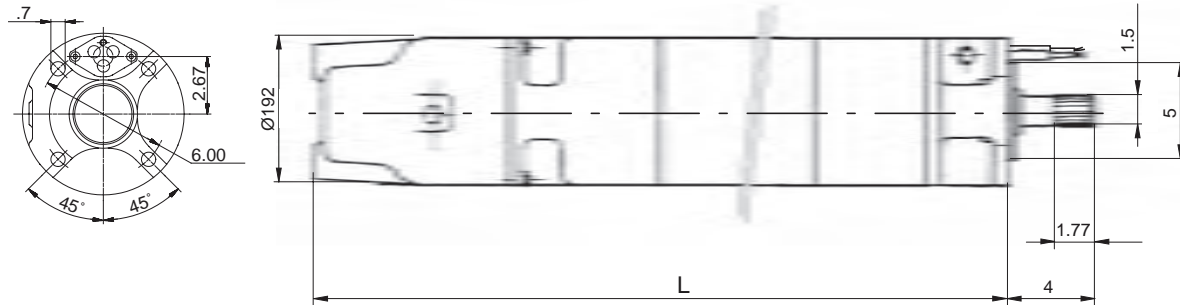
Cables

The 6" motors are connected by means of three single-core cables, approved for use with drinking water. All cables are round.

Being an integrated part of the motor, the motor cable cannot be fitted/removed once the motor is assembled.

Cable length: 16.4 ft

MMS 8000 (N)



TM03 3468 0406

Motor power		L [in]	Weight [lbs]	Shipping volume [ft ³]
P ₂ [kW]	P ₂ [hp]			
37	50	45.6	343.9	5.5
45	60	50	390.2	5.5
55	75	53.1	423.2	6.6
75	100	62.5	522.4	6.6
92	125	72	623.9	8.4
110	150	81.1	734.1	8.4

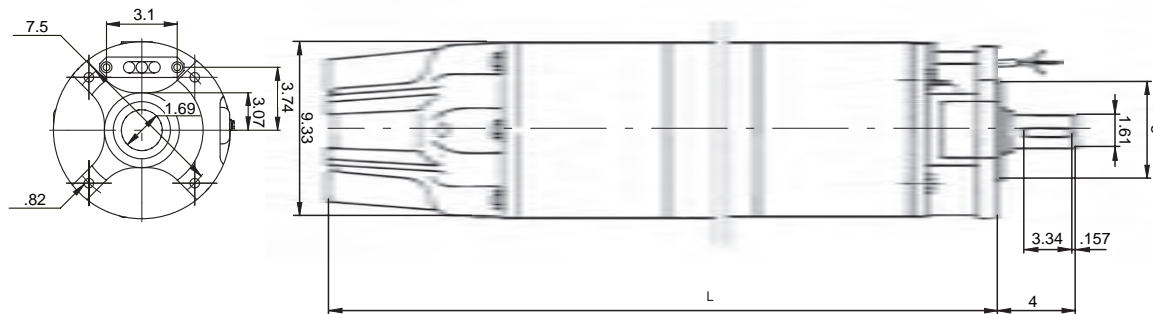
Cables

The 8" motors are connected by means of three single-core cables, approved for use with drinking water. All cables are round.

Being an integrated part of the motor, the motor cable cannot be fitted/removed once the motor is assembled.

Cable length: 26.2 ft

MMS 10000 (N)



TM03 3466 0406

Motor power		L [in]	Weight [lbs]	Shipping volume [ft ³]
P ₂ [kW]	P ₂ [hp]			
75	100	55.1	617	14.6
92	125	59	727	14.6
110	150	66.5	848.7	14.6
147	200	81.5	1102	17.4
190	260	94.5	1278	19.9

Cables

The 10" motors are connected by means of three single-core cables, approved for use with drinking water.

All cables are round.

Being an integrated part of the motor, the motor cable cannot be fitted/removed once the motor is assembled.

Cable length: 26.2 ft.

Grundfos MMS motor specifications

Type	Motor		SF	Amperage		Motor efficiency [%]	Power factor	Max thrust (lbs)	Line-to-line resistance (Ω)	KVA code
	Size	Power [hp]		Max	Start	η 100%	$\cos \phi$ 100%			
3 x 220 V, 60 Hz										
MMS 6000 (N)	6"	50	1.15	166	500	84	0.84	6000		G
3 x 460 V, 60 Hz										
MMS 6000 (N)	6"	50	1.15	79.0	470	84	0.83	13000	.378	G
MMS 8000 (N)	8"	40	1.15	64.0	380	83	0.85	13000	.350	K
		50	1.15	78.0	550	84	0.85	13000	.25	J
		60	1.15	92.5	640	86	0.85	13000	.18	K
		75	1.15	112	580	86	0.86	13000	.15	J
		100	1.15	150	570	87	0.86	13000	.13	J
		125	1.15	184	600	87	0.87	13000	.090	J
MMS 10000 (N)	10"	150	1.15	220	580	86	0.87	13000	.080	J
		100	1.15	154	570	87	0.84	13000	.092	J
		125	1.15	190	550	87	0.83	13000	.070	J
		150	1.15	224	580	88	0.84	13000	.055	J
		180	1.15	265	570	88	0.85	13000	.045	J
		200	1.15	305	620	87	0.82	13000	.040	K
3 x 575 V, 60 Hz										
MMS 8000 (N)	8"	260	1.15	405	610	87	0.79	13000	.033	K
		40	1.15	49.0	580	85	0.87	13000	.350	J
		50	1.15	60.5	580	85	0.88	13000	.250	H
		60	1.15	71.0	650	88	0.86	13000	.180	J
		75	1.15	86.5	650	89	0.86	13000	.150	J
		100	1.15	114	580	89	0.91	13000	.130	H
MMS 10000 (N)	10"	125	1.15	140	560	88	0.89	13000	.090	G
		150	1.15	176	570	89	0.84	13000	.080	H
		125	1.15	148	560	87	0.86	13000	.070	H
		150	1.15	176	570	87	0.87	13000	.055	H
		180	1.15	208	520	87	0.88	13000	.045	G
		200	1.15	234	610	88	0.86	13000	.040	J
		260	1.15	300	560	88	0.87	13000	.033	H

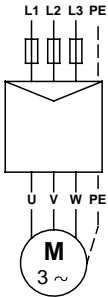
Wiring diagram

MMS motors are available for direct-on-line.

The wiring diagram is shown below.

MMS motor, direct-on-line starting

Connection of MMS wound for direct-on-line starting:



TM00 1364 5092

Fig. 5 DOL wiring diagram

MP 204



Nameplates

Rating and approvals of the MP 204.

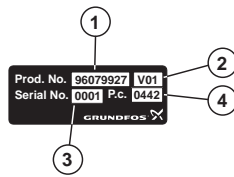


Fig. 6 Nameplate on front cover

These four numbers must be stated when contacting Grundfos:

Pos.	Description
1	Product number
2	Version number
3	Serial number
4	Production code

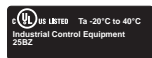
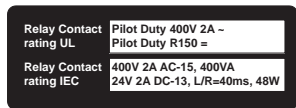
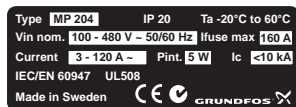


Fig. 7 Nameplates on the side of MP 204

Product range

- MP 204
- External current transformers up to 1000 A.

Functions

- Phase-sequence monitoring
- Indication of current or temperature (user selection)
- Input for PTC/thermal switch
- Indication of temperature in °C or °F (user selection)
- 4-digit, 7-segment display
- Setting and status reading with the R100
- Setting and status reading via the GENIbus.

Tripping conditions

- Overload
- Underload (dry running)
- Temperature (Tempcon sensor, PTC/thermal switch and Pt sensor)
- Missing phase
- Phase sequence
- Overvoltage
- Undervoltage
- Power factor (cos φ)
- Current unbalance.

Warnings

- Overload
 - Underload
 - Temperature (Tempcon, see section , and Pt sensor)
 - Overvoltage
 - Undervoltage
 - Power factor (cos φ)
- Note:** In connection with single- and three-phase connection.
- Run capacitor (single-phase operation)
 - Starting capacitor (single-phase operation)
 - Loss of communication in network
 - Harmonic distortion.

Learning function

- Phase sequence (three-phase operation)
- Run capacitor (single-phase operation)
- Starting capacitor (single-phase operation)
- Identification and measurement of Pt100/Pt1000 sensor circuit.

TM03 1471

TM03 1472 2205

TM03 1495 3605 TM03 1496 / 1421 2205

Factory settings

Current limit: 0 A

Nominal voltage: 400 V

Class: P (trip delay: 10 seconds)

Trip delay: 5 seconds

Number of phases: 3, non-earthed

Power-on delay: 2 seconds.

Learning function: Active.

Active trip limits

Overload according to class

Underload: -40%

Overvoltage: +20%

Undervoltage: -20%

Phase-sequence monitoring

Current unbalance: 10%

PTC/thermal switch.

Note: The overvoltage and undervoltage trip limits will be deactivated automatically if the temperature monitoring with Tempcon or Pt100/Pt1000 has been set to active.

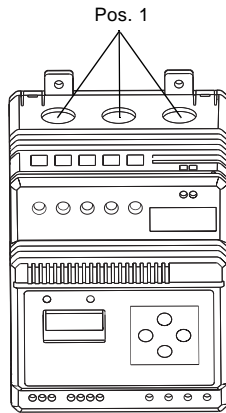
Active warnings

Run capacitor, low: -50%

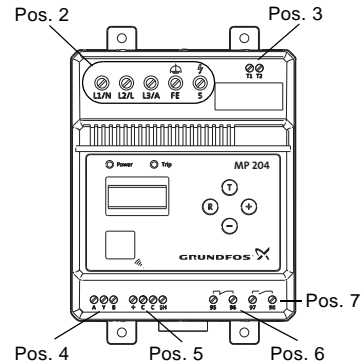
Starting capacitor, low: -50%.

Connection

Overview



TM03 0181 4404



TM03 0181 4505

Fig. 8 Cable entries

Fig. 9 Terminals

Pos.	Designation	Three-phase connection	Single-phase connection	Cable
1	I1	Entry for phase L1 to motor	Entry for neutral	Max. .16 in
	I2	Entry for phase L2 to motor	Entry for phase	
	I3	Entry for phase L3 to motor	Entry for auxiliary winding	
2	L1/N	Supply: L1	Supply: Neutral	Max. 10 AWG
	L2/L	Supply: L2	Supply: Phase	
	L3/A	Supply: L3	Auxiliary winding	
	FE	Functional earth		
	5	Insulation measurement		
3	T1	PTC/thermal switch		
	T2			
4	A	GENibus data A		
	Y	Reference/screen		
	B	GENibus data B		
5	+	Pt100/Pt1000 sensor		Max. 14 AWG
	C			
	C			
	SH	Screen		
6	95	Trip relay NC		
	96			
7	97	Signal relay NO		
	98			

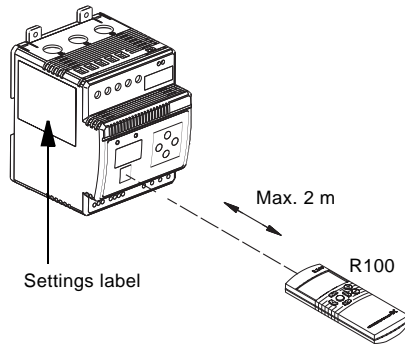
¹⁾ 8 AWG with cable terminal

²⁾ 12 AWG with cable terminal

R100 remote control

The R100 remote control is used for wireless communication with the MP 204. The R100 communicates via infra-red light. During communication, there must be visual contact between the R100 and the MP 204. See fig. 10.

The R100 offers additional settings and status readings for the MP 204.



TM03.0178.4404

Fig. 10 R100 and label


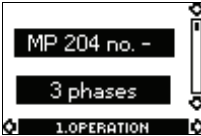

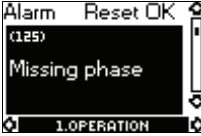
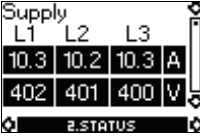
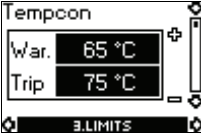


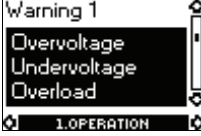
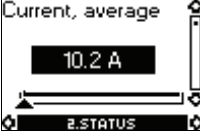
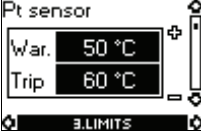
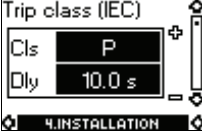

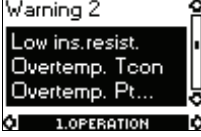
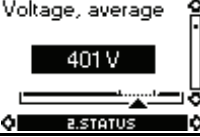
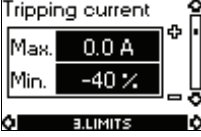



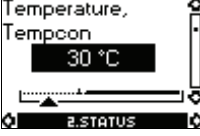
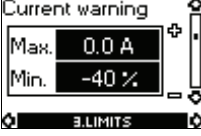



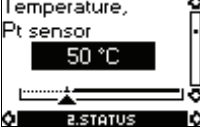


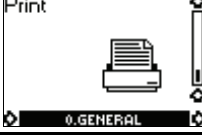
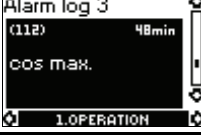
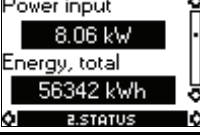
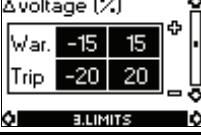
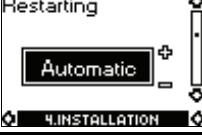
The settings label, which is enclosed, can be affixed to the MP 204 as required.

If the R100 comes into contact with more than one unit at a time, the number of the desired unit must be entered.

Below is the map for the R100 in conjunction with the MP204. This map is followed by the screen by screen procedures for setting up the MP204 protection for a Grundfos submersible motor. For a more complete and detailed use of the R100 with the MP204 for protection and monitoring of the Grundfos MS and MMS motors please see the I&O manual accompanying the MP204.

Menu structure

The menu structure for the R100 and MP 204 is divided into five parallel menus, each including a number of displays.

General	Operation	Status	Limits	Installation
	 START			
	 MP 204 no. - 3 phases 1.OPERATION			
 Switch off R100 0.GENERAL	 Alarm Reset OK (25) Missing phase 1.OPERATION	 Supply L1 L2 L3 10.3 10.2 10.3 A 402 401 400 V 2.STATUS	 Tempcon War. 65 °C Trip 75 °C 3.LIMITS	 Mains connection 3 phases 4.INSTALLATION
 Return to start 0.GENERAL	 Warning 1 Overvoltage Undervoltage Overload 1.OPERATION	 Current, average 10.2 A 2.STATUS	 Pt sensor War. 50 °C Trip 60 °C 3.LIMITS	 Trip class (IEC) Cls P Dly 10.0 s 4.INSTALLATION
 Delete all changes 0.GENERAL	 Warning 2 Low ins.resist. Overtemp. Tcon Overtemp. Pt... 1.OPERATION	 Voltage, average 401 V 2.STATUS	 Tripping current Max. 0.0 A Min. -40 % 3.LIMITS	 Trip delays 5 s 4.INSTALLATION
 Store settings 0.GENERAL	 Alarm log 1 (64) 1min Overtemperature, Tempcon 1.OPERATION	 Temperature, Tempcon 30 °C 2.STATUS	 Current warning Max. 0.0 A Min. -40 % 3.LIMITS	 External CT factor 1 4.INSTALLATION
 Call up settings 0.GENERAL	 Alarm log 2 (18) 29min External stop command 1.OPERATION	 Temperature, Pt sensor 50 °C 2.STATUS	 Nominal voltage 400.0 V 3.LIMITS	 Power-on delay 5 s 4.INSTALLATION
 Print 0.GENERAL	 Alarm log 3 (12) 48min cos max. 1.OPERATION	 Power input 8.06 kW Energy, total 56342 kWh 2.STATUS	 Δ voltage (%) War. -15 15 Trip -20 20 3.LIMITS	 Restarting Automatic 4.INSTALLATION

General

Operation

Status

Limits

Installation

Alarm log 4
(71) 427h22min
Overtemperature,
Pt100/Pt1000

1.OPERATION

Energy, trip counter
185 kWh

2.STATUS

Current unbalance
W.ar. 8.0 %
Trip 10.0 %

3.LIMITS

Autom. restarting
300 s

4.INSTALLATION

Alarm log 5
(123) 276847h
Starting capacitor,
low

1.OPERATION

Phase sequence
L1-L2-L3
Frequency
50.0 Hz

2.STATUS

Starting capacitor
W.ar. -25 %
Trip -50 %

3.LIMITS

Tempcon
Disable

4.INSTALLATION

Current unbalance
4.4 %

2.STATUS

Run capacitor
W.ar. -25 %
Trip -50 %

3.LIMITS

Pt sensor
Disable

4.INSTALLATION

Operating hours
1186 h 32 min.
Number of starts
46982

2.STATUS

Insulation resist.
W.ar. 100 kΩ
Trip 20 kΩ

3.LIMITS

Insulation measurement
Disable

4.INSTALLATION

Hours, trip counter
107 h 54 min.
Starts, trip counter
3879

2.STATUS

cos (φ) trip
Max. 0.99
Min. 0.40

3.LIMITS

PTC/thermal switch
Enable

4.INSTALLATION

Starting capacitor
152 μF

2.STATUS

cos (φ) warning
Max. 0.95
Min. 0.75

3.LIMITS

Reset trip counter
All

4.INSTALLATION

Run capacitor
47 μF

2.STATUS

Service
Serv. 5000 h
Starts/h 40

4.INSTALLATION

Insulation resist.
>1000 kΩ

2.STATUS

Restarts/24 h
Alarm Disable
Numb. 3

4.INSTALLATION

cos (φ)
0.82

2.STATUS

Units/display
Temp. SI
Displ. Crnt



4.INSTALLATION

Harmonic distortion
4.7 %

2.STATUS

Show cos(φ)/warn.
cos(φ) Enable
Warning Disable

4.INSTALLATION

General	Operation	Status	Limits	Installation
				<p>Number</p>  <p>4.INSTALLATION</p>
				<p>Learning</p>  <p>4.INSTALLATION</p>

Menu 3. LIMITS

The MP 204 operates with two sets of limits:

- a set of warning limits and
- a set of trip limits.

Some values only have a warning limit.

If one of the trip limits is exceeded, the trip relay stops the motor. Outputs 95-96 open, causing the control current to the contactor to be disconnected. At the same time, the signal relay, terminals 97-98, is closed.

The limit values should not be changed unless the pump has stopped.

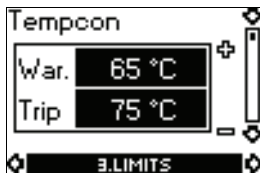
The trip limits must be set in accordance with the motor manufacturer's specifications.

The warning limits should be set to a less critical level than the trip limits.

If one or more of the warning limits are exceeded, the motor continues to run, but the warnings will appear in the MP 204 display, provided that this indication has been activated with the R100.

The warnings can also be read out with the R100.

Tempcon sensor



Set the warning and trip limits for the Tempcon sensor.

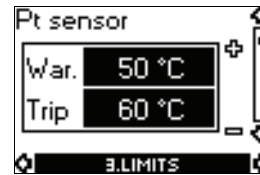
Factory setting:

- Warning: 65°C.
- Trip: 75°C.

Note: Above limits are not active until the Tempcon sensor has been activated.

Note: The overvoltage and undervoltage trip limits will be deactivated automatically if the temperature monitoring with Tempcon has been set to active.

Pt sensor



Set the warning and trip limits for the Pt sensor.

Factory setting:

- Warning: 50°C.
- Trip: 60°C.

Note: Above limits are not active until the Pt sensor has been activated.

Note: The overvoltage and undervoltage trip limits will be deactivated automatically if the temperature monitoring with Pt100/Pt1000 has been set to active.

Tripping current



Set the rated motor current in the "Max." field. (See motor nameplate.)

Factory setting:

- Max.: 0.0 A.

Set the min. current limit in the "Min." field. The min. current limit is typically a dry-running limit. The value is set in % of max. value.

Factory setting:

- Min.: -40%.

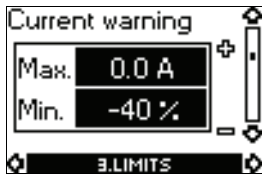
Example:

The rated motor current is 10 A.

The motor is to cut out (trip) at a current below 6 A.

Set "-40%" in the "Min." field.

Current warning



Set the warning limits for "Max." and "Min."
Set the max. warning limit in the "Max." field. The value is set in ampere.

Factory setting:

- Max.: 0.0 A

Set the min. warning limit in the "Min." field. The value is set in % of max. value.

Factory setting:

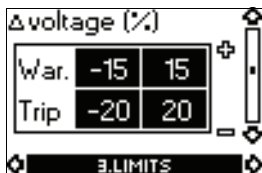
- Min.: -40%.

Nominal voltage



Set the nominal supply voltage.

Voltage limits



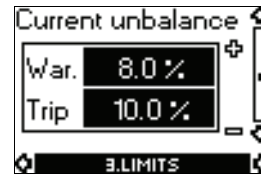
Set the warning and trip limits for under- and overvoltage.

Factory setting:

- Warning: ±15%.
- Trip: ±20%.

The values are set in % of nominal voltage.

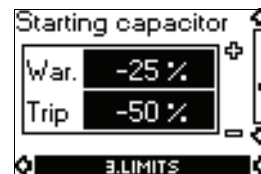
Current unbalance



Set the warning and trip limits for current unbalance.
Factory setting:

- Warning: 8.0%.
- Trip: 10.0%.

Starting capacitor



Set the warning and trip limits for the capacity of the starting capacitor.

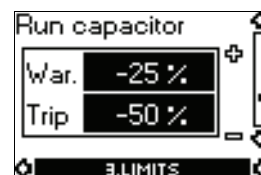
Factory setting:

- Warning: -25%.
- Trip: -50%.

The values are set as % of the value measured by the learning function.

Note: Setting is only possible when single-phase operation has been selected.

Run capacitor



Set the warning and trip limits for the capacity of the run capacitor.

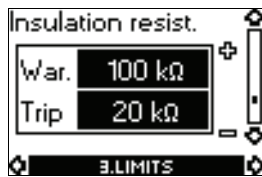
Factory setting:

- Warning: -25%.
- Trip: -50%.

The values are set as % of the value measured by the learning function.

Note: Setting is only possible when single-phase operation has been selected.

Insulation resistance



Set the warning and trip limits for the insulation resistance in the installation. The value set should be low enough to allow for an early indication of faults in the installation.

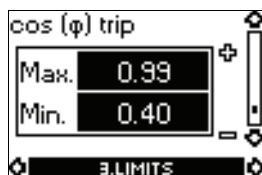
Factory setting:

- Warning: 100 kΩ.
- Trip: 20 kΩ.

Note:

- Insulation faults must be set to active to enable these limits.
- Setting is only possible when "3 phases w. FE" (functional earth) has been selected.

Cos φ trip



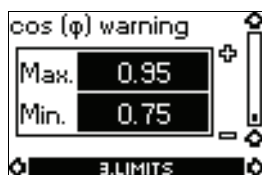
Set the trip limits for cos φ.

Factory setting:

- Max.: 0.99.
- Min.: 0.40.

This function can be used as dry-running protection when dry running cannot be detected by means of a current measurement.

Cos φ warning



Set the warning limits for cos φ.

Factory setting:

- Max.: 0.95.
- Min.: 0.75.

Menu 4. INSTALLATION

In this menu, it is possible to set a number of operating data and thus match the MP 204 to the actual installation. The installation values should not be changed unless the pump has stopped.

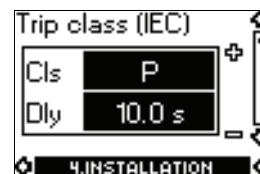
Supply mains



Set the supply mains to which the MP 204 is connected:

- 3 phases (non-earthed) (factory setting)
- 3 phases w. FE (functional earth)
- 1 phase.

Trip class



Line 1: Select IEC trip class (1 to 45).

If manual indication of trip delay in the case of overload is required, select trip class "P".

Factory setting:

- Cls (trip class): P.

Line 2: Select trip delay.

Factory setting:

- Dly (trip delay): 10 s.

Trip delay



Set the trip delay before the MP 204 trips.

Note: This does not apply to overload.

Factory setting:

- 5 s.

External current transformers



Set the external current transformer factor.
If no external current transformer is used, the factor is 1.

Factory setting:

- 1.

Note: Set the actual factor.

Example:

A current transformer with a 200:5 ratio is used and five windings through the MP 204 are made.

$$CT = \frac{200}{5 \cdot 5} = 8$$

Grundfos current transformers	Set CT factor
200:5	8
300:5	12
500:5	20
750:5	30
1000:5	40

Note: The above table only applies to Grundfos current transformers.

Power-on delay



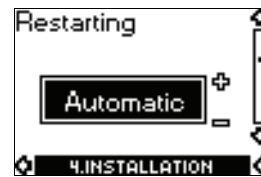
Number of seconds elapsing from the moment voltage is applied to the MP 204 until the activation of the trip relay (terminals 95-96) and signal relay (terminals 97-98).

Factory setting:

- 5 s.

Note: The motor cannot start during this delay.

Restarting



Set whether restarting after tripping is to be

- **Automatic** (factory setting)
- Manual.

Automatic restarting



Set the time after which the MP 204 is to attempt automatic restarting of motor after cut-out.

The time runs from the moment when the value which triggered the fault has returned to normal.

Factory setting:

- 300 s.

Tempcon sensor



Set whether a Tempcon sensor is incorporated in the motor.

- Enable
- **Disable** (factory setting).

If the Tempcon sensor is set to active and no Tempcon signal is received from the pump, the MP 204 display shows "----" instead of Tempcon temperature.

Note: The overvoltage and undervoltage trip limits will be deactivated automatically if the temperature monitoring with Tempcon has been set to active.

Pt sensor



Set whether a Pt sensor is connected.

- Enable
- **Disable** (factory setting).

If the Pt sensor is set to active and no signal is received from the sensor, the MP 204 display shows "----" instead of Pt temperature.

Note: The overvoltage and undervoltage trip limits will be deactivated automatically if the temperature monitoring with Pt100/Pt1000 has been set to active.

Note: The learning function registers automatically whether a Pt100/Pt1000 sensor is connected.

Insulation resistance measurement



Set whether insulation resistance measurement is to be made.

- Enable
- **Disable** (factory setting).
- If three-phase, earthed mains is selected, this setting is automatically changed to "Enable".
- If single-phase mains is selected, this setting is automatically changed to "Disable".

Note:

- The insulation resistance can only be measured if terminal "FE" is earthed and the supply mains is set to "3 phases w. FE".
- The leakage is measured when the MP 204 is powered and the motor stopped.
- The MP 204 must be connected in front of the contactor, and terminal "5" after the contactor.

PTC/thermal switch



Set whether a PTC/thermal switch is connected.

- **Enable** (factory setting)
- Disable.

Resetting of trip counters



Select the trip counters to be reset.

- **All** (all trip counters) (factory setting)
- Hours (operating hours)
- Starts (number of starts)
- Energy (energy consumption).

Service interval



Line 1: Set the number of hours of motor operation at which the MP 204 is to give a service warning in the display.

Factory setting:

- Service: 5000 h.

Line 2: Set the number of starts allowed per hour at which the MP 204 is to give a warning in the display.

Factory setting:

- Starts/h: 40.

Number of automatic restarts



Set the number of automatic restarts that the motor is allowed to make within 24 hours before cutting out.

Alarm:

- Enable
- **Disable** (factory setting).

Number:

- 40 (factory setting).

Note: If this tripped state occurs, the motor can only be restarted manually.

Units/display



Line 1: Set unit.

Temperature:

- **SI** (factory setting)
- US.

Note: If SI units have been selected, the temperature is indicated in degree Celcius (°C).
If US units have been selected, the temperature is indicated in Fahrenheit (°F).

Line 2: Select the MP 204 display indication during normal operation.

Display:

- **Crnt** (current) (factory setting)
- Tcon (Tempcon temperature)
- Pt sen.(Pt100/Pt1000 temperature).

MP 204 display



Line 1: Set whether the $\cos \varphi$ value is to be shown in the MP 204 display by means of the \oplus button.

$\cos \varphi$:

- **Enable** (factory setting)
- Disable.

Line 2: Set whether warnings are to be shown in the display.

Warning:

- Enable
- **Disable** (factory setting).

If display of warnings is active, the MP 204 display will switch from standard display (e.g. current) to warning code display when the limit value is exceeded. The remaining values can still be read out by means of the \oplus button.

GENibus ID number



Set ID number.

If several units are connected to the same GENibus, each unit must be assigned a unique ID number.

Factory setting:

- - (no number assigned).

Learning function



The learning function is active until the motor has been operating for a minimum of 120 seconds. The dot in the right side of the MP 204 display is flashing.

During the storing of the measured values, "LRN" appears in the MP 204 display.

Three-phase operation:

- Accepts the actual phase sequence as correct.
- If a Pt100/Pt1000 sensor is connected, the cable impedances to the sensor are measured.

Single-phase operation:

- Starting and run capacitors are measured.
- If a Pt100/Pt1000 sensor is connected, the cable impedances to the sensor are measured.

Note: The learning function changes to "not active" when the measurements have been made.

- **Active** (factory setting)
- Not active.

MP 204 with GENIbus

If several MP 204 units are connected to the same GENIbus, the connection is to be made as shown in fig. 11.

Note the connection of screen to conductive support. If the GENIbus has been in use, and bus communication monitoring has been activated, the MP 204 will continue to monitor the bus activity. If the MP 204 does not receive GENIbus telegrams, the MP 204 presumes that the GENIbus connection has been disconnected and indicates a fault on the individual units.

Each of the units in the chain must be assigned an identification number with the R100.

For further information about the GENIbus, see Web-CAPS at www.grundfos.com.

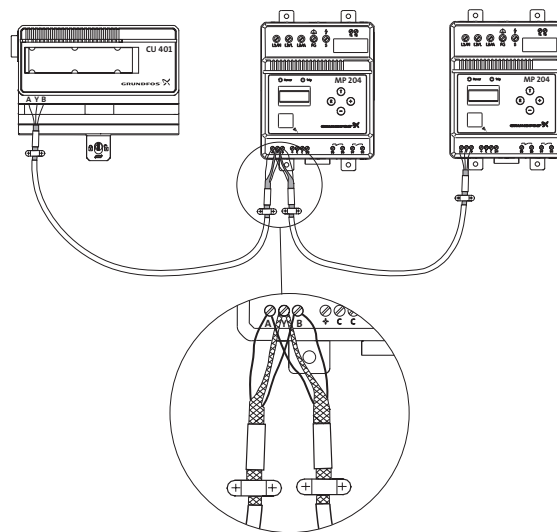


Fig. 11 GENIbus

Approvals and standards

The MP 204 conforms to:

- UL 508
- IEC 947
- IEC/EN 60335-1
- IEC/EN 61000-5-1
- IEC 61000-6-3
- IEC 61000-6-2
- EN 61000-6-3
- EN 61000-4-5
- EN 61000-4-4
- EN 61000-4-6.

TM03 0173 4304

Submersible pumps

Submersible pumps normally have a short start-up time. Trip class "P" can therefore be applied with advantage for these pumps. It is possible to set very short times down to for example 900 ms, used for certain specific applications.

To prevent the Tempcon signal from one submersible pump from interfering with the signal from another, cabling must be carefully made to allow measurements to be made of both pumps at the same time. The motor cables must be kept apart and not installed in the same cable tray. To avoid interference, it may be necessary to fit a filter on the supply cables. See fig. 12.

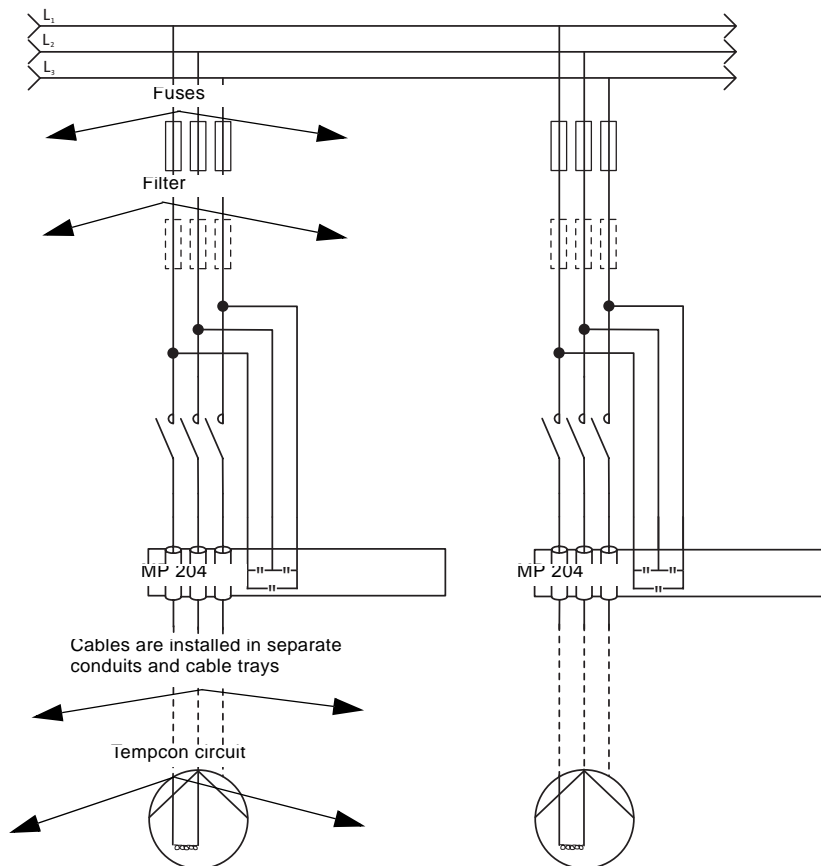


Fig. 12 Submersible pump installation with Tempcon

TM03 1356 1805

Electrical data

Three phase, 60 Hz

Motor rating		Copper wire size													
Volts	HP	14	12	10	8	6	4	2	0	00	000	0000	250	300	
460	1 1/2	1700	-	-	-	-	-	-	-	-	-	-	-	-	
	2	1300	2070	-	-	-	-	-	-	-	-	-	-	-	
	3	1000	1600	2520	-	-	-	-	-	-	-	-	-	-	
	5	590	950	1500	2360	-	-	-	-	-	-	-	-	-	
	7 1/2	420	680	1070	1690	2640	-	-	-	-	-	-	-	-	
	10	310	500	790	1250	1960	3050	-	-	-	-	-	-	-	
	15	-	-	540	850	1340	2090	3200	-	-	-	-	-	-	
	20	-	-	410	650	1030	1610	2470	3730	-	-	-	-	-	
	25	-	-	-	530	830	1300	1990	3010	3700	-	-	-	-	
	30	-	-	-	430	680	1070	1640	2490	3060	3700	-	-	-	
	40	-	-	-	-	-	790	1210	1830	2250	2710	3290	-	-	
	50	-	-	-	-	-	640	980	1480	1810	2190	2650	3010	-	
	60	-	-	-	-	-	-	830	1250	1540	1850	2240	2540	2890	
	75	-	-	-	-	-	-	-	1030	1260	1520	1850	2100	2400	
	100	-	-	-	-	-	-	-	-	940	1130	1380	1560	1790	
	125	-	-	-	-	-	-	-	-	-	-	1080	1220	1390	
	150	-	-	-	-	-	-	-	-	-	-	-	1050	1190	
200	-	-	-	-	-	-	-	-	-	-	-	1080	1300		
250	-	-	-	-	-	-	-	-	-	-	-	-	1080		
575	1 1/2	2620	-	-	-	-	-	-	-	-	-	-	-	-	
	2	2030	-	-	-	-	-	-	-	-	-	-	-	-	
	3	1580	2530	-	-	-	-	-	-	-	-	-	-	-	
	5	920	1480	2330	-	-	-	-	-	-	-	-	-	-	
	7 1/2	660	1060	1680	2650	-	-	-	-	-	-	-	-	-	
	10	490	780	1240	1950	-	-	-	-	-	-	-	-	-	
	15	-	530	850	1340	2090	-	-	-	-	-	-	-	-	
	20	-	-	650	1030	1610	2520	-	-	-	-	-	-	-	
	25	-	-	520	830	1300	2030	3110	-	-	-	-	-	-	
	30	-	-	-	680	1070	1670	2560	3880	-	-	-	-	-	
	40	-	-	-	-	790	1240	1900	2860	3510	-	-	-	-	
50	-	-	-	-	-	1000	1540	2310	2840	3420	-	-	-		
60	-	-	-	-	-	850	1300	1960	2400	2890	3500	-	-		
75	-	-	-	-	-	-	1060	1600	1970	2380	2890	3290	-		
100	-	-	-	-	-	-	-	1190	1460	1770	2150	2440	2790		

1. If aluminum conductor is used, multiply lengths by 0.5. Maximum allowable length of aluminum is considerably shorter than copper wire of same size.
2. The portion of the total cable which is between the service entrance and a 3Ø motor starter should not exceed 25% of the total maximum length to assure reliable starter operation. Single-Phase control boxes may be connected at any point of the total cable length.
3. Cables #14 to #0000 are AWG sizes, and 250 to 300 are MCM sizes.

Pt100

The Pt100 sensor allows

- continuous monitoring of the motor temperature
- protection against too high motor temperature.

Protecting the motor against too high motor temperature is the simplest and cheapest way of avoiding that motor lifetime is reduced. Pt100 ensures that operating conditions are not exceeded and indicates when it is time for service of the motor.

Monitoring and protection by means of Pt100 require the following parts:

- Pt100 sensor with cable
- Relay type EDM 35 or PR2202.

The EDM 35 relay is fitted with a Pt100 module. For both relays the following temperature limits are pre-set on delivery:

- 60°C warning limit
- 75°C stop limit.

Technical data

	Relay type	
	EDM 35	PR 2202
Enclosure class	IP 65	IP 50
Ambient temp.	0°C to +50°C	-20°C to +60°C
Relative humidity	90%	90%
Voltage variation	-10/+10% of nominal voltage	24 VDC -20/+20% of nominal voltage
Frequency	50/60 Hz	
Approvals	UL, CSA, SEV	
Mark	CE	

Example: Pt100 for Grundfos MMS submersible rewindable motors



TM01 8141 5089

Fig. 13

Product range

Pt100 sensor including cable

Cable length	Product number	
	MS 6000 and MMS 6000, MMS 8000	MMS 10000, MMS 12000
20 m	96408957	96437784*
40 m	96408684	96437785*
60 m	96408958	96437786*
80 m	96408959	96437787*
100 m	96408960	96437788*

* Incl. fitting.

Submersible power cable

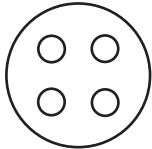

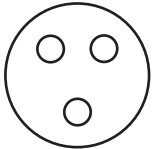

Power is transmitted from the starter/controller to the submersible motor through a marine duty power cable, typically consisting of three flexible stranded conductors of the proper size to carry the motor full load amperes (FLA) at its rated voltage. AWWA standards require a separate ground wire to be provided (ie. 3-wire cable systems are equipped with three power conductors and a ground wire of the same size).

Proper cable selection is a function of motor load, voltage, available space, length (setting depth) and environment.

Typical conductor insulation materials are synthetic rubber (RW, RUW, TW, etc.), plastic (PVC, XPLE, etc.) or special polymer (FPE, hypalin, EPR - EPDM, etc.). Special cable insulations are often recommended or required for sever duty or special applications such as; gas, hydro - carbon, heat, variable frequency, etc.

Cable can be provided as three or more separate individual or, twisted conductors, molded side by side in a flat cable configuration or three conductors with a round common jacket. Refer to Table 4 for general submersible power cable physical data (weight and diameter). Armored cable is also available for special applications, but is typically not employed in the water supply industry. Cable is supported and attached to column/drop pipe by means of cable clamps, tape or bands. One extra foot of cable for each fifty feet of length should be allowed plus an additional ten to fifty feet for surface connections.

(Table 4) Typical submersible power cable physical data

Cable Size	600 Volt (115, 208, 230, 460 and 575 Volt Motors)				5000 Volt (2300 Volt Motors)			
	Type I		Type II		Type III		Type IV	
	3 Conductors and ground in a Common Jacket (4 wire total)		3 Conductors and ground in Separate Jackets (4 wire total)		3 Conductors in a Common Jacket (3 wire total)		3 Conductors in Separate Jackets (3 wire total)	
								
AWG MCM	O.D. (in)	Wt. (lbs./ft.)	O.D. (in) per Cable	Wt. (lbs./ft.) for 4 Cables	O.D. (in)	Wt. (lbs./ft.)	O.D. (in) per Cable	Wt. (lbs./ft.) for 3 Cables
14	.39	.16	.19	.10				
12	.43	.20	.21	.13				
10	.64	.32	.27	.18				
8	.76	.44	.31	.29	1.02	.69	.39	.43
6	.91	.65	.36	.43	1.10	.85	.43	.52
4	1.02	.90	.42	.64	1.21	1.12	.47	.71
2	1.15	1.26	.48	.97	1.33	1.46	.53	.99
1	1.34	1.68	.58	1.26	-	-	-	-
0	1.43	2.0	.62	1.54	1.51	2.09	.62	1.49
00	1.53	2.41	.67	1.91	1.61	2.56	.66	1.87
000	1.64	2.89	.72	2.36	-	-	-	-
0000	1.80	3.58	.78	2.93	1.82	3.40	-	-
250	1.97	5.88	.90	4.82	-	-	-	-
300	2.09	6.60	.95	5.62	-	-	-	-
350	2.20	7.34	1.00	6.50	2.51	4.8	-	-
400	2.34	8.18	1.05	7.25	-	-	-	-
500	2.25	9.30	1.13	8.87	-	-	-	-

- Types I and II cables are typically insulated and jacketed with synthetic rubber, PVC or XLPE.
- Types II and IV are often supplied paralleled in a flat cable configuration, or in a twisted configuration for smaller sizes. Type I and II cable include 3 power conductors and a ground conductor.
- AWWA minimum stranding and insulation requirements; No. 10 and smaller - 7 strand/ Class B, No. 9 through No. 2 - 19 strand/ Class C, No. 1 through 4/0 - 19 strand/ Class B. Minimum conductor area to meet minimum ICEA (Insulated Cable Engineers Association) code for operation in free air.
- Verify actual cable weight per foot with manufacture for greater accuracy, as weight and diameter will vary with insulation system and manufacture.

Cable selection

Maximum cable lengths are generally calculated to maintain 95% of service entrance voltage at the motor running at maximum nameplate amps, and to maintain adequate starting torque. Calculations take into account basic cable resistance, reactance, power factor and temperature rise cable larger than specified may always be used, and will reduce power consumption. The wire sizing chart in the Electrical Data section tabulates copper cable sizes for various cable lengths vs motor size. The use of power cables smaller than the minimum sizes as permitted by code or recommended by Grundfos will generally void the motor warranty. Undersized cable sizes will cause reduced starting torque and poor motor operation.

Mixed cable

In a submersible pump installation any combination of cables sizes may be used provided they do not exceed the individual maximum conductor ampacity limit and the aggregate voltage drop does not exceed 5% of the motor nameplate voltage while operating at full load. Mixed cable sizes are most often encountered when a pump is being replaced with a larger horsepower unit.

Cable splice

When the downhole power cable (drop cable) must be spliced or connected to the motor leads, it is necessary that the splice be water tight. Under normal service conditions, the splice can be made using commercially available potting compounds, heat shrink or tape. Each type of splicing methods is affective when made by competent personnel, potted or head shrink splices are recommended when submergence pressures exceeds 25 psi (60'). A cable splice should exhibit a minimum insulation resistance of 10 megohms, measured in a submerged state after 24 hours in water. A typical low voltage (< 600V) tape splice is illustrated below in Figure 9.

When three conductors are encased in a single outer sheath, tape individual conductors as described, staggering joints. Total thickness of tape should be no less than the thickness of the conductor insulation.

Motor lead

Most manufactures will provide a factory motor lead assembly, pre-potted and designed to provide a water tight connection between it and the motor terminals. Typical motor lead length range from 48" to 150" and are generally spliced to the drop cable immediately above the pump. Minimum wire sizes (AWG) for factory provided motor lead assemblies, by nominal motor size are; 4" - #14 to #12, 6" - #10 to #8, 8" - #4 and 10" - #2.

In general, a motor lead assembly should not be reused as rubber compounds typically used in there construction will set with time, making a water tight connection difficult. Grundfos installation instructions, which includes pot head connecting torque values and lubrication requirements, should be strictly observed.

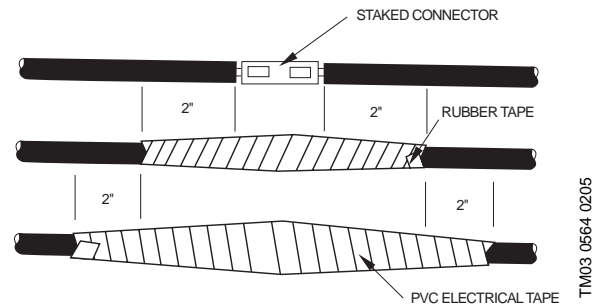


Fig. 14 Tape Splice

TM03 0564 0205

In addition to this printed data booklet, Grundfos offers the following sources of product documentation.

- WinCAPS
- WebCAPS.

WinCAPS

WinCAPS is a **Windows-based Computer Aided Product Selection** program containing information on more than 185,000 Grundfos products.

Available on CD-ROM in more than 22 languages, WinCAPS offers

- detailed technical information
- selection of the optimum pump solution
- dimensional drawings of each pump
- detailed service documentation
- installation and operating instructions
- wiring diagrams of each pump.



Fig. 15 WinCAPS CD-ROM

cd-wincaps

Click **Catalogue** and select a product from the extensive product catalogue.

Click **Sizing** and select the most suitable pump for your application.



Fig. 16 WinCAPS

WinCAPS

WebCAPS

WebCAPS is a **Web-based Compute Aided Product Selection** program and a web-version of WinCAPS.

WebCAPS is accessible on Grundfos' homepage, www.grundfos.com, and offers

- detailed technical information
- dimensional drawings of each pump
- wiring diagrams of each pump.

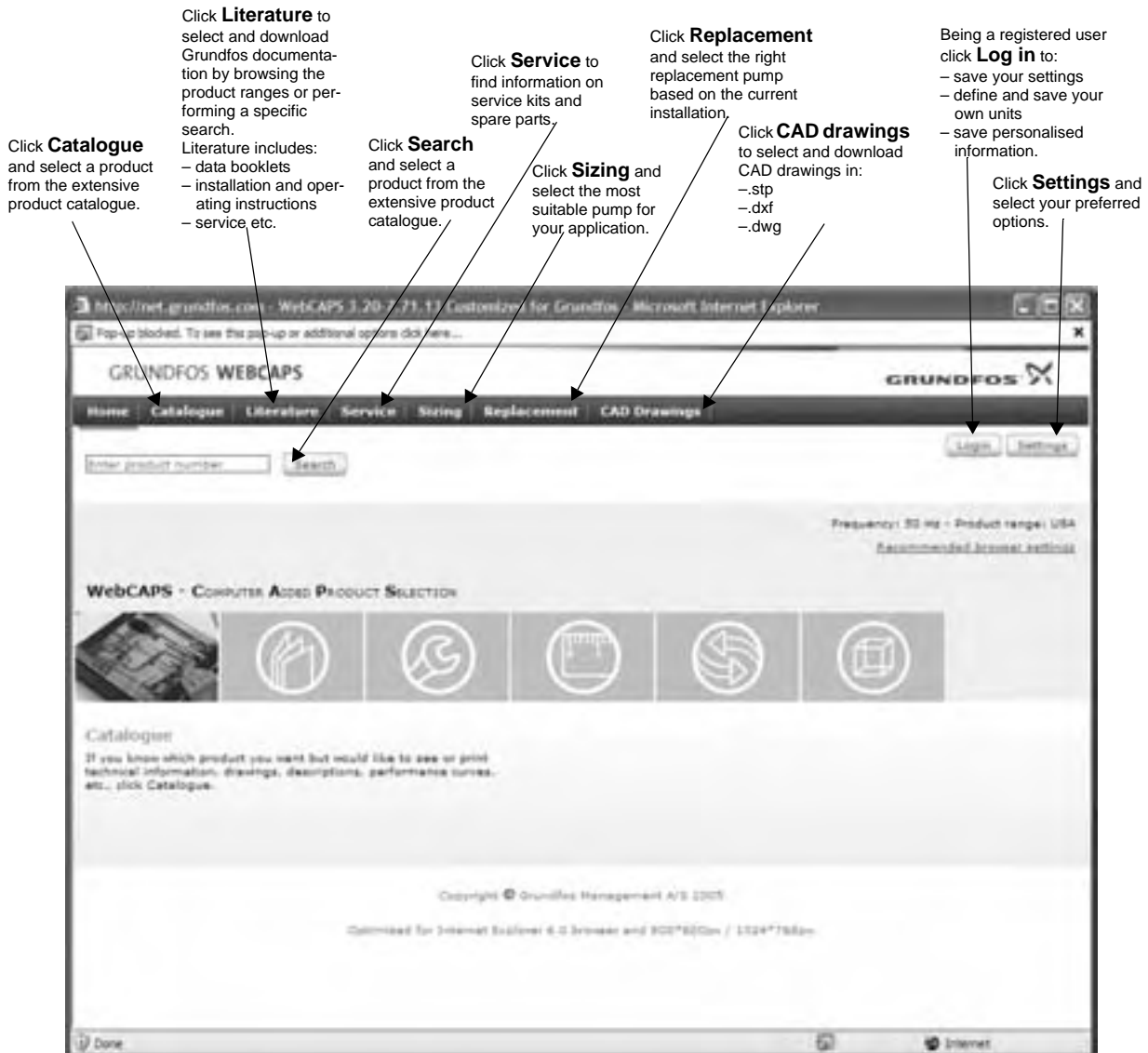


Fig. 17 WebCAPS

WebCAPS

L-MMS-PG-01 04/06	US
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Subject to alterations.

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